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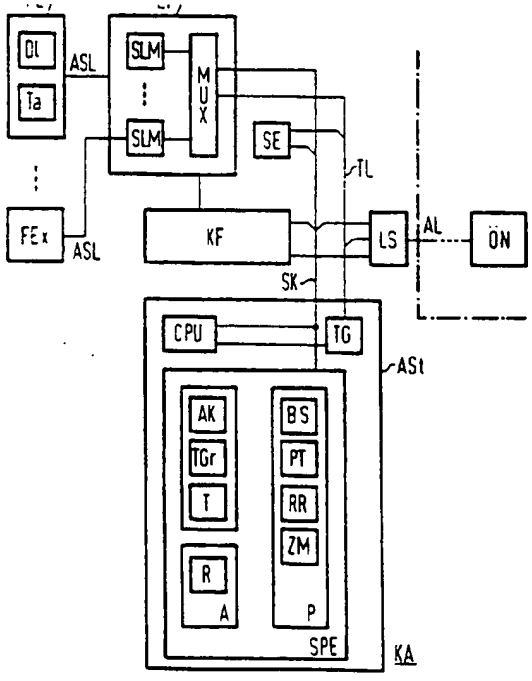
(54) Program-controlled telecommunication system with the option of automatic callback

(57) Following an unsuccessful connection set-up between two communication terminal devices connected to a communication system, a callback can be initiated in the calling terminal device. The callback order is entered in appropriate storage devices, and the identifiers which determine the participating terminal devices are stored. Following detection of the transition into the idle condition of the terminal device that was originally called unsuccessfully, the connection set-up procedure is initiated by the system control only after the expiration of a predetermined delay time. This delay time can be variably preset by means of a "timer", whereby various times can be preset, even in dependency on predetermined subscriber groups. Because of the delayed initiation of the callback, the subscriber thus has the option of immediately afterward establishing an additional call connection necessitated by the previous call. He is not disturbed in the meantime by a compulsory callback call allocated to him by the system. The length of the selected delay time should be matched to usual subscriber behavior.



The invention pertains to a telecommunication system for the connection of communication terminal devices, in which a central controller is present which carries out the switching control and coordination, and which has a system memory for the storing of the program modules and, from the system configuration, the data pertaining to the call-specific information and the identifiers to be entered by the subscribers, and which has at least one system processor to which, under the control of an operating system, the program modules are assigned for execution, whereby following an unsuccessful connection set-up between two connected communication terminal devices, a callback order which causes the central controller to carry out an automatic connection set-up between the relevant communication terminal devices at the calling terminal device can be stored in the system memory.

Such communication systems are used for connecting terminal devices to each other and to connect these terminal devices with terminal devices which are connected to communication networks, particularly to public communication networks. In principle, the communication system consists of a multiplicity of switching functional units and a programmable digital computer system that controls these functional units and supervises all switching operations. For this purpose, the computer system is provided with information regarding the operating status of the functional units and regarding the changes of status, particularly with regard to entries made at the connected terminal devices. As a result, it can immediately prepare and output appropriate control instructions and messages as needed.

In contemporary program-controlled communication systems, and particularly in contemporary telephone private branch exchanges, a number of different features are known which, first, increase user convenience, and second, provide call options which go beyond the basic switching functions. As a rule, the terminal units being used exhibit, along with the number keypad, additional function keys to which various functions can be allocated by means of a suitable operating instruction. Through their actuation, it immediately becomes possible to make use of features or certain services, for example. One example of such a feature is the so-called callback, whereby it is possible to distinguish between the busy condition and the idle condition of the called subscriber terminal device. With "callback if busy", if the called communication terminal device is busy, an automatic callback order is initialized - for example, by pressing a corresponding key on the calling communication terminal device - and after being transmitted to the communication system, it is stored in the latter, e.g., in a dynamic call memory allocated to the called communication terminal device. When the desired communication terminal device becomes idle, the original calling subscriber who has entered a callback receives a call. After he takes the call, a connection to the called communication terminal device is produced. In the case of communication terminal devices that are digitally connected to the communication system, the callback orders can be visually displayed at the communication terminal device in question.

When a subscriber calls a communication terminal device that no one answers, he can likewise enter an automatic callback order and end the call. If the desired subscriber is there again and if, for example, he makes a call over the originally called communication terminal device, the subscriber who initiated the callback receives a call. After he takes this call, the desired communication terminal device will likewise be called, with the stored directory number of the originally called subscriber being used.

Thus, with both of the callback versions, immediately after the ending of a call connection by the terminal device which was at first called unsuccessfully, an automatic connection set-up takes place between the communication terminal devices stored within the context of a callback order, whereby the actual production of the connection then takes place when the subscriber answers.

The task of the invention is to prevent the freedom of disposition of a subscriber in a communication system offering the automatic callback option from being unreasonably restricted with regard to a renewed connection set-up.

That is achieved through the fact that, depending on the available callback order information, following the detection of the transition of the originally called communication terminal device into the idle state, the connection set-up procedure for the callback connection is initiated by the central system controller only after expiration of a predetermined delay time.

It can be assumed that after a call connection has been ended, in a majority of cases a subscriber would like to make a new call connection, which will be directly related to the first, immediately after that. The fundamental aspect of the invention is now to be seen in the fact that the option of making such a call

connection is given to a subscriber, because the callback order initiated by another subscriber is not carried out right away. The subscriber is thus not restricted in his ability to act freely by an immediately subsequent call connection which is not convenient for him at that time and which is sent to him automatically by the system controller on the basis of a callback order. The time by which the connection set-up procedures related to a callback connection are delayed can be adapted to a specific traffic behavior. This also depends on the situation existing at a specific workplace. Even in cases in which a subscriber on his own does not want to make a further call immediately after the previous call, a certain "quiet time" before the compulsory offering of a subsequent callback connection will be found welcome. In those cases in which the presence of an existing order for a callback is displayed to a subscriber on his terminal device, he now has the option of deciding, before the temporally delayed assignment of this callback connection, whether to make a call on his own, or first wait for the callback call. Thus, as a result of the solution according to the invention, the subscriber is allowed to retain in an appropriate way his own freedom of decision for various situations subsequent to a previously completed call.

According to a further development of the invention, the delay time can be preset by a timing element that can be adjusted by means of an operational order. This timing element should be realized by means of software. In general, the delay time can be "system administered", i.e., it can apply in the same way for all connected terminal devices. However, a specific delay time can also be preset for at least one part of the connected communication terminal units combined into a group, whereby this delay time can be specified differently for each of a multiplicity of predefined groups. Along with such a group-dependent, general delay time, however, it can also be set individually for specific terminal devices. Particularly in the case of so-called small communication systems, this individual specification can be carried out for every telephone terminal device. The relevant delay time for each is preset for the terminal devices in question in a suitably stored allocation table.

In accordance with a further development of the invention, the delay time can be determined by means of a statistical evaluation of the call-related behavior of a subscriber that is to be carried out on the basis of a suitably implemented program. In conjunction with that, the delay time is derived from the time spans that have been determined between successive call connections relative to one terminal device. Of course, the delay time determined in this way is then stored by the system controller in the allocation table mentioned above.

In principle, through the fact that in accordance with the invention a callback connection is no longer initiated at the earliest possible time following the ending of a call, but only after expiration of a certain "quiet time", also prevents another subscriber from using a callback order to easily draw a conclusion regarding the length of a call which took place. It is even possible that several calls took place before the requested callback connection was switched through.

The invention is described in the following with the aid of an embodiment shown in the form of a figure. Shown schematically in the figure is the structure of a digital communication system. Only those components necessary for understanding the invention are shown.

The central component of the communication system KA, which represents a so-called private branch exchange, is a central switching network KF by means of which terminal devices - of which the telephone terminal devices FE and FEx are indicated schematically - can be connected with each other or to lines AL leading to a public switching system ÖN. The central switching network KF is under the control influence of a central system controller ASt that also contains, along with the central processor CPU, a storage device SPE and a clock unit TG. The central processor controls all of the switching operations and provides for preparation and distribution of the control data. These jobs can also be divided up among several processors.

Located in the communication system KA are line termination devices that are symbolized by the line termination device LT. Each of them contains subscriber line modules SLM. The subscriber line modules SLM are connected via the subscriber lines ASL with the communication terminal devices FE through FEx, whereby in principle two different subscriber line modules SLM are provided. They are, first, subscriber line modules SLM for the connection of analog communication terminal devices FE, and second, subscriber line modules SLM for the connection of digital communication terminal devices FE.

The subscriber line module SLM for the connection of analog communication terminal devices represents the link between the analog communication terminal devices, e.g., telephone terminal devices FE, and the communication system KA. For example, this subscriber line module SLM contains devices for the connection of a predetermined number of subscriber lines ASL. Each subscriber line module SLM is equipped with the necessary feed, ringing and indication circuits, along with two-wire/four-wire converters and analog/digital

and digital/analog converters for the speech information conversion. The digital or digitized speech information is sent via a multiplexing device MUX to the digital switching network KF, for example.

The subscriber line module SLM for the connection of digital communication terminal devices FE represents the link between ISDN communication terminal devices and the communication system KA. A digital subscriber line module SLM is provided for the connection of a very specific number of digital communication terminal devices. With this, the transmission of messages takes place, via message channels, for example, and the signaling is transmitted via an additional channel. The digital speech information transmitted from the communication terminal device FE is likewise passed along to the switching network KF via a multiplex device MUX.

In terms of switching, the line termination devices LT are controlled by the system controller ASt. In conjunction with this, each line termination device is connected with the system controller via a signaling channel SK. Information is exchanged over this signaling channel SK with the aid of the HDLC transmission procedure that is known in the art. The clock signals that are formed in the central system controller are distributed to the line termination devices LT via a clock line TL. The [component that] maks these clock signals available is symbolized by the TG unit.

The central processor CPU of the central system controller ASt has access to the information stored in the storage device SPE. It consists of several storage sections, whereby the system operating program BS and the programs associated with it in regard to the periphery, operations, security and switching - symbolized by the block PT - are stored in the program memory P. RR designates a program module which is provided for the execution of callback procedures. Program module ZM is used for the implementation of, for example, time spans which can be preset by means of operational orders. For example, in this way, in conjunction with the corresponding clock information, various times can be defined and the callback procedures will not be activated until after these times expire.
The operational orders can be entered, for example, by means of an operating device that is connected with the system controller via a standardized bus. In the case of smaller communication systems, a communication terminal device FE can also be defined as a control terminal.

Stored in storage section KD of the storage device SPE are the customer data such as, for example, the authorizations assigned to the individual terminal devices FE and the system customer configuration AK. Relative to the delayed execution of a callback, it is also possible to store in the customer data memory, gathered into groups, those communication terminal devices for which a predetermined delay time was entered by means of an operational order. In the same way, the relevant allocation tables for delay times which are to be specified separately for individual communication terminal devices FE could also be stored there.

Data which are extracted from the database during a connection set-up initiated by means of a communication terminal device FE can be at least partially brought into working memory A. This working memory is used for, among other things, the holding of temporary data for program flow control. In connection with the delay provided in accordance with the invention for the initiation of the callback orders, for example, it is possible to store in storage section R of this working memory A the callback order in combination with the connection addresses of the telephone terminal devices provided for the callback connection, or in combination with the identifiers which define these terminal devices.

Access to an exchange line AL via which - possibly as one of several - the communication system KA is connected with the public network ÖN, for example, takes place via the interface LS. This interface contains, for example, an ISDN section that can be configured, for example, as a standardized So interface. The periphery of the communication system KA is supplemented by a signaling unit SE that is present to supply the communication system with signals.

Let us assume that a connection set-up is initiated from a calling telephone terminal device FE to a called telephone terminal device FEx. Following the audible indication of the connection request at the called telephone terminal device FEx, however, the connection does not come into being because the relevant subscriber of the called telephone terminal device is absent, for example. A connection is likewise impossible if the desired terminal device is busy. Using the latter case, let us now assume that at the calling telephone terminal device FE the feature "callback" is initialized - for example, by pressing the callback key provided for that purpose. Such a telephone terminal device has a display DI and a keyboard Ta, as is indicated in the Figure. This keyboard Ta includes the numerical keys, which are not shown in detail, for the entering of dialing information, and additional keys, also not shown, for the entering of additional functions. Through the actuation of the available function keys features can be activated which can, for example, be implemented by means of the system-operating program. The

callback request that has been entered by a subscriber, e.g., through actuation of a key, is signaled to the communication system KA via the subscriber line ASL and is transmitted to the central system controller ASt via the particular subscriber line module SLM or the multiplex device MUX. In the event of a call connection that is not completed, for example, the controller enters into storage section R of the working memory A identifiers or connection addresses which specify the participating communication terminal devices FE and FEx. Following the ending of the call connection, i.e., after the handset has been hung up or after an action equivalent to this hanging up, this entered information is used for the set-up of a connection between the unsuccessfully called communication terminal device FEx and the original calling terminal device FE. When a callback order is entered upon the idle state, it applies in the same way with the ending of the next call made from this terminal device.

For the implementation of feature-specific control procedures, the controller contains individual program controllers which access the control data held in the corresponding modules of the storage device SPE. In the case according to the invention, this pertains to modules RR and ZM, whereby the latter supplies certain time information during the execution of a callback order. This takes place in cooperation with the central clock unit TG and in dependency on information that may be contained in the customer data memory. In principle, a callback order is not executed at the earliest possible point in time following the detection of the transition into the idle state of the communication terminal device originally called unsuccessfully, rather, it takes place only after the expiration of a specific delay time. This can be a uniform delay time specified for the communication system. However, it is also possible to define a different delay time for individual subscriber groups, each of which, for example, is stored separately in section TGr. In principle, it is also conceivable to provide for individual telephone terminal devices a delay time which differs from the general delay time. In an allocation table T stored in the customer data memory, individual terminal devices can be allocated the delay time which each desires. During the set-up of a callback connection, the controller checks to see which particular delay times have to be taken into consideration. This particular delay time is then used by the controller, in cooperation with the time module ZM and the central clock unit TG, as the basis for the delayed execution of a callback order.

It is also possible to specify the delay time automatically in dependency on the traffic behavior of a subscriber. To do this, in a statistical evaluation of a predetermined number of calls, the amounts of time between them are determined. They then form the basis for the determination, using meaningful algorithms, of a delay time that is automatically taken into consideration for the production of a callback connection.

With the variable setting of the delay time for the initialization of a callback connection, there is also the possibility of taking into consideration the wishes of subscribers in this regard. A meaningfully chosen delay time can be as much as two minutes. This offers the subscriber a chance to set up a subsequent call he wishes to make, or to carry out some other call-related activities immediately thereafter undisturbed. On the other hand, at the same time there is also a certain guarantee that the subscriber is still present at his workplace.

As has already been mentioned, up until the automatic allocation of a callback connection, in principle, a subscriber could have made several calls. It is therefore no longer possible for another subscriber to use a callback order to determine the duration of any individual call. This ability to check exists in the case of the non-delayed execution of a callback order. Such a check would be very easy for another subscriber to carry out, especially in those cases in which the busy state of a terminal device is visually displayed by at least one other terminal device.

Patent Claims

1. Telecommunication system for the connection of communication terminal devices, in which a central controller (ASt) is present which carries out the switching control and coordination, and which has a system memory (SPE) for the storing of the program modules and, from the system configuration, the data pertaining to the call-specific information and the identifiers to be entered by the subscribers, and which has at least one system processor (CPU) to which, under the control of an operating system, the program modules are assigned for execution, whereby following an unsuccessful connection set-up between two connected communication terminal devices, a callback order is storable in the system memory at the calling terminal, which causes the central controller to carry out an automatic connection set-up between the relevant communication terminal devices
characterized in that

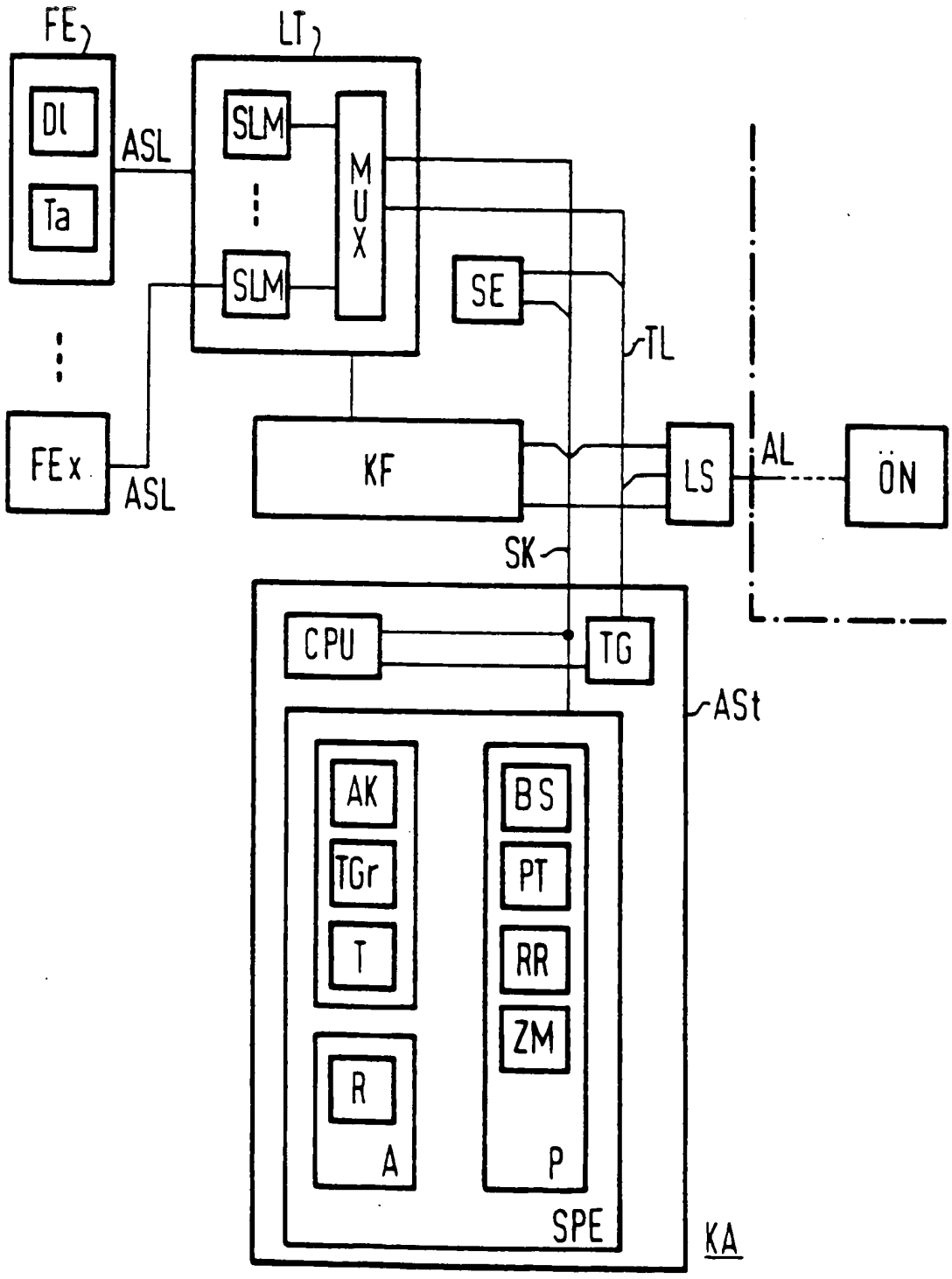
depending on the callback order information, which is present following the detection of the transition into the idle state of the communication terminal device that was originally called unsuccessfully, the connection set-up procedure for the callback connection is initiated by the central system controller only after the expiration of a predetermined delay time.

2. Telecommunication system according to Claim 1, **characterized in that**
the delay time can be preset by means of a timing element (ZM, TG) which can be set to one of several different time ranges by means of an operational order.

3. Telecommunication system according to Claim 2, **characterized in that**
a specific delay time can be preset for a portion of the connected communication devices combined into at least one group (TGr), [and] that this delay time can be defined differently for a multiplicity of such groups.

4. Telecommunication system according to Claim 2 or 3,
characterized in that
for specific communication terminal devices also allocated to a group, a delay time to be specified individually is preset in a suitably stored allocation table (T).

5. Telecommunication system according to Claim 4, **characterized in that**
relative to one communication terminal device, the delay time is derived from a statistical evaluation of the time span existing between successive call connections, and that this derived time is automatically actively preset by the system controller as the definitive delay time.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